

## PATENT SPECIFICATION

623,316

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## PROVISIONAL SPECIFICATION

## Improvements in and relating to Building Units

We, THOMAS WALLACE PARKER and JACK FORESTER RYDER, both British Subjects, and both of the Building Research Station, Garston, Near Watford, Hertfordshire, do hereby declare the nature of this invention to be as follows:—

This invention relates to building units made of an aggregate consisting of or comprising finely divided wood such as sawdust and a binder of hydraulic cement such as Portland cement. Such combination of ingredients will be referred to hereinafter as sawdust-cement.

An inherent disadvantage of sawdust-cement is that it exhibits considerable dimensional changes during hardening and also during subsequent wetting and drying. Changes during hardening lead to warping or even cracking of some shapes of unit, while subsequent changes lead to failures when the units are fixed under restraint, for example by bonding units together with a cement-sand or cement-lime-sand mortar, or by bolting them together. Both the shape and the method of use of this material are therefore subject to limitations.

Both ingredients contribute to the dimensional changes but the sawdust has the greater influence.

In the case of concrete units, that is units made of an aggregate of graded inert mineral and a binder of hydraulic cement such as Portland cement, it is well known that they exhibit much reduced dimensional changes when cured under high-pressure steam than when cured in air or in water. This process also results in a much accelerated rate of hardening of the concrete and is used as a means of rapid production. The curing in steam is applied within a few hours of casting and the total time from casting to the unit being ready for use is of the order of 24 hours as against days or weeks with ordinary curing.

This process cannot be applied to sawdust-cement because it is found that the mass does not acquire any strength in the steam curing process. Sawdust has an

adverse effect on the setting and hardening of cement and it is usually necessary to introduce some form of treatment of the sawdust to overcome this. Even with simple treatments, however, the adverse effect on pressure steam curing still persists probably because the effect of the steam is to extract or make more available the deleterious ingredients in the sawdust which effect the cement.

According to our invention sawdust-cement units are cast and cured in air in the ordinary way, and after they have attained adequate strength for their purpose we subject them to an atmosphere of high pressure steam. We have found that under such treatment, though no further increase in strength occurs, indeed it may fall off somewhat, and though the units increase in volume slightly, their subsequent wetting and drying movements are markedly reduced. The conditions of autoclave temperature, pressure, and period of treatment commonly used in the manufacture of sand-lime bricks, or concrete products, are suitable for the purpose of our invention, but there is some latitude both in temperature and degree of saturation of the steam. The minimum period required for treatment will vary both with the temperature and with the size of specimen to be treated. Preliminary trials to determine the optimum conditions may require to be made, but as an example, the results quoted in the Table were obtained in the laboratory on specimens steamed for 4 hours at a temperature of 183°C. and pressure of 160 lb. per sq. in.

The invention can be applied to sawdust-cement in which the aggregate consists of sawdust alone or of sawdust mixed with an inert mineral aggregate. For example, it is sometimes convenient to use a mixture of sawdust and brick dust. It can also be applied to sawdust-cement mixes which have been aerated during manufacture by any of the known methods; for example, by the introduction of gas-forming materials, such as alu-

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minium powder, by the introduction of foaming agents into the mix, or by the use of a prepared foam added to the mix. The sawdust is used treated or untreated according to its nature, and if treatment is necessary or desirable the well-known

lime treatment may be used or that described in Patent Specification No. 560,801.

The table below illustrates test results which have been obtained and also serves 10 as examples of suitable mixes, using lime treatment.

TABLE.

15	Mix proportions	Curing treatment	Strength		Dimensional changes (per cent.)		
			Transverse (Modulus of rupture lb./sq. in.)	Compressive (lb./sq. in.)	On autoclaving	Drying shrinkage	Wetting expansion
20	1 vol. cement, 1 vol. sawdust + 25 per cent. hydrated lime on the vol. of the cement	Stored in moist air 7 days Stored in moist air for 7 days, then autoclaved	—	—	—	0.278	0.183
25	1 vol. cement, 2 vols. sawdust + 25 per cent. lime as above	Stored in moist air 7 days Stored in moist air for 7 days, then autoclaved	610	2290	+0.129	0.088	0.073
30	1 vol. cement, 1½ vols. sawdust, ½ vol. brick dust + 25 per cent. lime as above	Stored in moist air 7 days Stored in moist air for 7 days, then autoclaved	411	1120	—	0.349	0.217
35	1 vol. cement, 1½ vols. sawdust, ½ vol. brick dust + 25 per cent. lime as above	Stored in moist air 7 days Stored in moist air for 7 days, then autoclaved	390	1180	+0.194	0.128	0.104
40	1 vol. cement, 2 vols. sawdust, 1 vol. brick dust + 25 per cent. lime as above	Stored in moist air 7 days Stored in moist air for 7 days, then autoclaved	460	1550	—	0.302	0.148
			300	975	—	0.084	0.071
			280	810	—	0.300	0.146
			227	640	—	0.096	0.078

Dated this 29th day of April, 1947.

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## COMPLETE SPECIFICATION

## Improvements in and relating to Building Units

We, THOMAS WALLACE PARKER and JACK FORESTER RYDER, both British Subjects, and both of the Building Research Station, Garston, Near Watford, Hertfordshire, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

10 This invention relates to building units made of an aggregate consisting of or comprising finely divided wood such as sawdust and a binder of hydraulic cement such as Portland cement. Such combination of ingredients will be referred to hereinafter as sawdust-cement.

An inherent disadvantage of sawdust-cement is that it exhibits considerable dimensional changes during hardening 20 and also during subsequent wetting and drying. Changes during hardening lead to warping or even cracking of some shapes of unit, while subsequent changes lead to failures when the units are fixed 25 under restraint, for example by bonding units together with a cement-sand or cement-lime-sand mortar, or by bolting them together. Both the shape and the method of use of this material are therefore 30 subject to limitations.

Both ingredients contribute to the dimensional changes but the sawdust has the greater influence.

In the case of concrete units, that is 35 units made of an aggregate of graded inert mineral and a binder of hydraulic cement such as Portland cement, it is well known that they exhibit much smaller dimensional changes when cured 40 under high-pressure steam than when cured in air or water. This process also results in a much accelerated rate of hardening of the concrete and is used as a means of rapid production. The curing 45 in steam is applied within a few hours of casting and the total time from casting to the unit being ready for use is of the order of 24 hours as against days or weeks with ordinary curing.

50 This process cannot be applied to sawdust-cement because it is found that the mass does not acquire any strength in the steam curing process. Sawdust has an adverse effect on the setting and hardening of cement and it is usually necessary 55 to introduce some form of treatment of the sawdust to overcome this. Even with simple treatments, however, the adverse

effect on pressure steam curing still persists probably because the effect of the 60 steam is to extract or make more available the deleterious ingredients in the sawdust which effect the cement.

According to our invention sawdust-cement units are cast and cured in air in 65 the ordinary way, and after they have attained adequate strength for their purpose we subject them to an atmosphere of high pressure steam. We have found 70 that under such treatment, though no further increase in strength occurs, indeed it may fall off somewhat, and though the units increase in volume slightly, their subsequent wetting and drying movements are markedly reduced. The conditions of 75 autoclave temperature, pressure, and period of treatment commonly used in the manufacture of sand-lime bricks, or concrete products, are suitable for the purpose of our invention, but there is some 80 latitude both in temperature and degree of saturation of the steam. The minimum period required for treatment will vary both with the temperature and with the size of specimen to be treated. Preliminary trials to determine the optimum 85 conditions may require to be made, but as an example, the results quoted in the Table were obtained in the laboratory on specimens steamed for 4 hours at a temperature of 183°C. and pressure of 160 90 lb. per sq. in.

The invention can be applied to sawdust-cement in which the aggregate consists of sawdust alone or of sawdust mixed 95 with an inert mineral aggregate. For example, it is sometimes convenient to use a mixture of sawdust and brick dust. It can also be applied to sawdust-cement mixes which have been aerated during 100 manufacture by any of the known methods; for example, by the introduction of gas-forming materials, such as aluminium powder, by the introduction of foaming agents into the mix, or by the use 105 of a prepared foam added to the mix. The sawdust is used treated or untreated according to its nature, and if treatment is necessary or desirable the well-known lime treatment may be used or 110 that described in Patent Specification No. 560,801.

The Table below illustrates test results which have been obtained and also serves as examples of suitable mixes, using lime 115 treatment.

TABLE.

5	Mix proportions	Curing treatment	Strength		Dimensional changes (per cent.)		
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		Stored in moist air for 7 days, then autoclaved	610	2290	+0.129	0.088	0.073
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20	1 vol. cement, 1½ vols. sawdust, ½ vol. brick dust + 25 per cent. lime as above	Stored in moist air 7 days	460	1550	—	0.302	0.148
		Stored in moist air for 7 days, then autoclaved	300	975	—	0.084	0.071
25	1 vol. cement, 2 vols. sawdust, 1 vol. brick dust + 25 per cent. lime as above	Stored in moist air 7 days	280	810	—	0.300	0.146
		Stored in moist air for 7 days, then autoclaved	227	640	—	0.096	0.078

Having now particularly described and ascertained the nature of our said invention and in what manner the same is to be performed, we declare that what we claim is:—

1. A process for the manufacture of sawdust-cement building units in which the units are cast and cured in air in the ordinary way, and after they have attained adequate strength for their purpose, are subjected to an atmosphere of high pressure steam.

2. A process according to Claim 1 in which the cement is Portland cement.

3. A process according to Claim 2 in which the steam treatment is the same as that commonly used in the manufacture of sand-lime bricks or of concrete products.

4. A process according to Claim 2 in

which the steam treatment comprises steaming the units for 4 hours at a temperature of 183° C. and a pressure of 160 lbs per square inch.

5. A process according to any preceding claim in which the aggregate consists of sawdust mixed with an inert mineral.

6. A process according to any preceding claim in which the sawdust-cement mix is aerated during manufacture.

7. Sawdust-cement building units produced by the process claimed in any preceding claim.

Dated this 11th day of March, 1948.

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